Industrial Archaeology Hiding in Plain sight

Ordnance Survey Benchmarks and Trig Points

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Geographic maps (ones that represent the real world to scale) are a relatively new idea. Cartographers produced globes and maps to help plan sea voyages and military campaigns from the 16th Century onwards. We see them as an intuitive idea, but we were taught to read them when we were at school. In earlier days, few people understood what a map was or how to read one.

In the 17th and 18th Century, the French Crown hired three generations of the Casini family to map the whole of France. In England, owners of large estates commissioned maps of their properties and the first County maps emerged. Surveying equipment was primitive and the maps were inaccurate and expensive. New measuring technology appeared – the wooden ruler with accurate divisions, the surveying chain, the pedometer (a wheel on a stick with a revolution counter).

The first large-scale mapping project by the UK government was William Roy's survey of Scotland, soon after the Union. Originally the interest was from the Army for the purposes of control, which is why the Board of Ordnance ran the project, but gradually it became more about getting to know our own nation.

At this time, the idea that the Government should do useful things for the public good was new. The Postal Service and the survey of Sotland were two of the first such projects.

In 1783 the French Government proposed that the British should map the South of England and link the two surveys together across the Channel. Amongst other benefits, this would give a long baseline to allow a better estimate of the size of the Earth, then known only approximately.

The surveyors used trigonometry, the mathematics of the ancient Greeks, preserved through the medieval by the Moors. The technique was to measure the length of a baseline as accurately as possible, then sight on some distant objects from each end and measure the angles and elevations. Doing that gives the relative positions of all the objects. These become the Primary Points of the survey. Take measurements from them to get the positions of objects in between, which become the secondary points, and so on.

In 1784 Roy's team measured a five-mile baseline across Hounslow Heath, which was then a particularly flat piece of open country to the South of London.

Surveyors' chains and wooden rulers laid on trestles were not stable enough, so they used ten-foot (3m) long glass rods instead.

Once the surveyors had an accurate base they used one of the first theodolites (which weighed 200 pounds) to sight on distant objects. A point on the top of Leith Hill Tower became one of the first primary trig points. Its position is marked by a brass bolt which you can still see today in the centre of the roof of the tower. The ends of the baseline were marked by wooden posts, which were later replaced by two buried cannons.

The surveyors then headed for the South Coast, measuring as they went, building cairns of stones to mark the positions that they measured.

The suburb of Hounslow grew up around the baseline. Today one end is just outside the boundary fence of Heathrow Airport and the other is in a suburban street called Roy Grove in memory of William Roy and his survey.

The survey was one of the UK's great projects of the Enlightenment and it generated widespread public interest. Roy and other members of the survey became celebrities.

By around 1790 what became known as The Ordnance Survey was established as the UK's mapping authority. A French invasion via the South Coast was expected, so surveying that region was the priority. After Waterloo the threat receded, but the mapping project continued.

The first complete survey of England, Wales, Scotland and Ireland took 80 years with maps emerging one by one. As well as measuring the landscape, the team had to get to grips with place names in dialect English and the various forms of Celtic. People on different sides of a mountain might know it by two different names, and rules had to be created to decide which one was "correct". The first maps were expensive, about 20 days pay of a skilled man's pay each, but ordinary folk could access them in the new lending libraries. Over the years, they became cheaper.

Through the 19th Century, towns and cities expanded, roads and railways were built, all of which meant constant resurveying and republishing. Meanwhile the technology of measurement improved, partly driven by the OS. Theodolites became smaller and more portable. When one of the first spotlights emerged from chemistry research, it was developed by OS Surveyor Thomas Drummond into an instrument to allow sighting on distant objects at night. Originally known as "the Drummond Light", later it was used in the theatre and became known as "the limelight".)

As OS maps became cheaper, the middle and working classes of the cities used them to discover the countryside, as many of us still do, lockdown permitting. There was an interesting change of attitude amongst the educated. William Shakespeare was bought up in a small village in Warwickshire and moved to the big city to find success. Plays such as A Midsummer Night's Dream portray the English countryside as a dangerous anarchic place, which no town dweller in their right mind would visit. Later romantic writers such as Wordsworth popularised the countryside as the equal of the finest European landscapes.

The resulting staycation vogue coincided with the later years of the first OS survey, and the surveyors wrote of the nuisance caused by tourists from the cities infesting the landscape while they were busy measuring it. It's not clear whether they realised that they were the indirect cause of the problem.

I was bought up in a suburb on the edge of Manchester which is surrounded by green belt land. At 600 acres, nearby Heaton Park claims to be the largest municipal park in Europe. In the nineteenth century it and other local estates were a magnet for mill workers from all over the city on their one day off each week. There's a pub called The Railway and Naturalist, a name that seems to be unique. One theory is that it served the thousands of Manchester Ramblers who came in by train every Sunday. (To be fair, another is that it commemorates railway surveyor and early evolutionist Alfred Wallace.)

This invasion by the great unwashed was not always welcomed by landowners. The Kinder Scout Mass Trespass of 1932 was a landmark in opening access to the countryside. https://www.prints-online.com/mass-trespass-kinder-scout-4458573.html. Nowadays we see this as a breakthrough in access to the countryside. The contrast between that and the attitude of the local newspaper at the time is interesting: "Peak District ramblers in trouble".

James Walker Tucker's 1936 painting Hiking shows a more respectable version of the country walk. Three smart examples of the New Woman, with the latest hairstyles and properly dressed for the occasion. They have all the right camping gear and an OS map, which they clearly know how to use. No male guide needed, and probably much more acceptable to The Surrey Advertiser than a few hundred northern mill workers.
https://www.theguardian.com/artanddesign/2019/may/10/james-walker-tucker-hiking

The Network of Markers

The early cairns that marked the survey points were prone to collapse or vandalism – some locals, suspicious of the survey's purpose, were said to move them deliberately. They were replaced by brick pillars about 30 cm high and then the four-foot high concrete trig pillars that we recognise today. The surveyors also placed metal bolts and other markers in handy buildings, as at Leith Hill.

Apart from the trig pillars in the countryside, they left benchmarks in the towns. These are lines scored on the walls of buildings to mark the height above sea level at that point. They are useful when laying out a building site. In Leatherhead you can find one on the wall of the Parish Church, in Neates Alley by the dental practice, on the wall of the Penny Black pub and in many other places. (See the Sources below for how to find them.)

In 1935 the OS started a new national survey using state of the art equipment. Interrupted by the Second World war, it was completed in 1962. This survey introduced the hefty concrete trig pillars, plus thousands of surface blocks, concrete blocks about 18 inches wide sitting on the surface with a metal bolt marking the reference position. More mysterious in purpose are the buried blocks, which are exactly what the name implies. Why bury them?

The surveyors created all these markers themselves as they worked, which could involve them climbing a mountain, carrying building materials and survey equipment.

The result is a network of markers with positions known to an accuracy of about 1 metre, a remarkable feat for that technology. The result, distributed across the whole country, and which we now take for granted, is a monument to a huge and heroic project run over two centuries to map the Nation.

Redundancy

In the last few years, the OS has adopted new technology such as aerial photography, Lidar and GPS. In particular, they now use a smaller network of Active (GPS) Stations, accurate to 2cm.

Many people say that they prefer a paper map to a GPS system. I see their point, but it's worth pointing out that for the past fifteen years or so, the paper maps have been derived from GPS data. It's just that somebody else took the readings for you.

Accurate GPS equipment used to be prohibitively expensive, but lately it's got much cheaper and I've been experimenting with building my own. To test it I needed some objects with a known published position, which is how I came to be wandering around Surrey last year, looking for OS trig points.

There is one problem, which is that GPS uses its own coordinate system, different from and incompatible with traditional OS map references. You can convert from one to the other, but that adds an error of about one metre, completely compromising the extra accuracy of GPS. So, the OS map reference could be the next thing to go.

Accurate GPS has made the physical markers redundant. The OS put their benchmark and trig point data into the public domain and forgot about them. Enthusiasts used those data to create the Trigpointing website and the Benchmarking website, and that led to a new hobby, Trigpointing, which involves visiting trig points while out walking and logging reports about their condition.

The OS facility at Newlyn for measuring average sea level is now a listed structure, but the trig points and benchmarks are not, and with a few exceptions, nobody takes responsibility for them. The trig pillars will probably last for centuries, although the one on Box Hill is already cracked, letting in the frost each winter. Many are on private property in farmers' fields and the gardens of houses – one near Leatherhead is used as a garden ornament.

The surface blocks are in the most immediate danger, prone to being gradually buried. Bookham was served by three of them, all now disappeared. The bolts and the benchmarks on the walls of buildings are also vulnerable, easily removed during construction projects.

And so industrial archaeology is made and lost.

Sources

Mercator: The Man who Mapped the Planet by Nicholas Crane, pub Orien 2002

Map of a Nation by Rachel Hewitt, pub Granta 2010

On the Map by Simon Garfield, pub Profile Books 2012

The Trigpointing website lists the position of all trigpoints: http://trigpointing.uk/.

The Benchmarking website lists the position of the benchmarks: https://www.bench-marks.org.uk/.

BBC4 has made a number of programmes about maps and mapping, which it repeats every couple of years:

- Mapping the Nation
- Maps: Power, Plunder and Possession
- The Beauty of Maps https://www.bbc.co.uk/programmes/b00s2w83

The last is currently (September 2020) available on the iPlayer. BBC4 repeats all these programmes every couple of years. Keep an eye out for them.

A radio programme about Mercator is also available: https://www.bbc.co.uk/programmes/w3cszjv7.